

15.

Plankton of the Bermuda Oceanographic Expeditions. XI. Bathypelagic Nemerteans of the Bermuda Area and Other Parts of the North and South Atlantic Oceans, with Evidence as to Their Means of Dispersal.¹

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(Plates I and II; Text-figures 1-26).

[This is one of a series of papers dealing with the plankton collections of the Bermuda Oceanographic Expeditions of the Department of Tropical Research, New York Zoological Society, made under the direction of Dr. William Beebe during the years 1929, 1930 and 1931. For complete trawling data, refer to Beebe, *Zoologica*, Vol. 13, Nos. 1 (1931), 2 (1931) and 3 (1932).]

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INTRODUCTION.

Previous reports (Coe, 1935, 1936) on the bathypelagic nemerteans taken in the years 1929, 1930 and 1931 by the Bermuda Oceanographic Expeditions of the New York Zoological Society under the direction of Dr. William Beebe contained an account of the 79 specimens which were available for study at that time. These included 12 species belonging to 10 genera, of which 6 species and one genus were new to science. The collections also contained material which made possible the description of both sexes in 4 species of which only one of the two sexes had been previously described.

The 1936 report was illustrated by photo-

¹Contribution No. 716, Department of Tropical Research, New York Zoological Society.

²Contributions from the Scripps Institution of Oceanography, New Series No. 261.



TEXT-FIG. 1. Correlation of the distribution, insofar as at present known, of six of the species of bathypelagic nemertean found in the Bermuda area with the approximate directions of flow of the water masses which they inhabit. Numerals indicate the approximate distances from the surface at which the intermediate water masses are flowing. Broken lines are used for less well authenticated currents. Abbreviations indicate: **A.I.W.**, arctic intermediate water; **A.A.I.W.**, antarctic intermediate water; **M.W.**, Mediterranean water; **B.**, Bermuda area. (Modified from Sverdrup, Johnson and Fleming, "The Oceans," 1942, with additional data through the courtesy of Dr. Sverdrup).

graphs of preserved specimens of each species, as well as by drawings showing the internal anatomy. Descriptions were given of such of the morphological details of each species as had not been previously reported. Information was also included as to the depth at which each specimen was found, together with the geographical distribution of the species as known up to that time.

The present, supplementary, report is based upon additional material which was collected at the same time as that included in the earlier reports and which has since become available for study. It includes descriptions and figures of two new species, *Mononemertes scarlata* and *Parabalaena-nemertes nigra*, and the diagnosis of one new genus, *Calonemertes*.

DISTRIBUTION.

The collections were all made by Dr. William Beebe in a relatively minute portion of the deep subtropical Atlantic Ocean. This portion was a circular column of water eight miles in diameter, with its center located at 32°12' N. Lat., 64°36' W. Long., about nine miles southeast of Nonsuch Island, Bermuda. The nets were drawn horizontally across this area so as to collect samples simultaneously at 200-meter intervals from depths of about 1,000 to 2,000 meters. During the years 1929, 1930 and 1931 a total of 1,042 nets one meter in diameter were drawn at these depths in all directions across this eight-mile cylinder of water.

Because of the fact that the nets were drawn to the surface while still open, there is always a possibility that any particular individual may have actually been caught at a higher level than that at which the net was drawn horizontally. However, if the same species was not also caught in any of the nets drawn horizontally at the higher levels there is small probability that the species lives there.

The nets were drawn horizontally for periods of about four hours after the bottom net had reached the depth of about 2,000 meters and then drawn vertically to the surface. It must be remembered, however, that the nets did not enter exactly the same water in successive years nor even in successive days, for the ocean currents are constantly transporting the water from one portion of the ocean to another. Through the agency of these currents the constituent planktonic fauna of any particular water mass is being slowly but continually distributed to other geographical areas.

Because of this continuous flow of the water masses the actual volume of water through which the nets passed during the three summers must have been vastly greater than that of an equal cylinder of stationary water. The water masses at the locality mentioned during the summer of one year were doubtless far distant the following summer and the bathypelagic fauna collected on any particular date must have arrived at that locality just in time to be caught by the nets. We may therefore assume that the sexually mature worms contained in the collections studied may have originated as young individuals some miles distant and that their offspring may live in some other part of the ocean not too far away.

It must not be assumed, however, that these water masses with their suspended faunas are flowing like a river in a single direction, for oceanographers have determined that the generally onward movement

of the water is the resultant of innumerable streams with side eddies flowing in all directions. Hence it is not inconceivable that an individual which may have once narrowly escaped the net in the Bermuda area may nevertheless have been caught in the same net at the same place some weeks or months later, after having made a circuit outside the area in the meantime.

The water layer which forms the habitat of most species of bathypelagic nemerteans lies at a depth of 1,200 to 2,000 or more meters in the Bermuda area. The temperature averages about 4° Centigrade, being 5.3° at 1,200 meters and 3.5° at 2,000 meters. The salinity is from 34.99 to 35.08 parts per thousand. Water masses with these characteristics are continuous throughout the North Atlantic, being at a higher level in the north and deeper in the south. Because of the low temperatures at these depths, the viscosity of the water is sufficient to enable the nemerteans with their horizontally flattened, gelatinous bodies to support themselves with a minimum of muscular effort.

The region off the coast of Bermuda where the collections were made is particularly favorable for a wide variety of bathypelagic animals because of the admixture of ocean waters derived from several widely separated sources (Sverdrup, Johnson and Fleming, 1942)³. Such evidence as is at present available indicates that the intermediate ocean water which the nemerteans inhabit, at depths of 1,200 to 2,000 meters, has a large component of water of subantarctic origin (Text-fig. 1). This moves in a generally northerly direction at a rate which has been estimated as at least one-half centimeter per second or perhaps 400 meters per day. That would indicate a movement approaching one mile in four days. If it could be assumed that such a flow is continuous and at a rate of approximately 90 miles per year, it would require a period of only about 40 to 50 years to bring a population of these worms from the South Atlantic to the Bermuda area. From the Bermuda area the population may be carried farther to the north or deflected toward the east and thence to the middle Atlantic. Other currents may return the population southward and thence to the South Atlantic.

A second source of the intermediate water off Bermuda is a current originating in the subarctic region of the Atlantic (Text-fig. 1). This flow is less well differentiated than that from the South Atlantic but it doubtless brings from higher levels

³ For additional data relative to the movements of these water masses of intermediate depths, the writer is indebted to Dr. H. U. Sverdrup, Director of the Scripps Institution of Oceanography.

in the north, water which sinks to greater depths off Bermuda. Consequently it need occasion no surprise to find that *Nectonemertes mirabilis*, which may be found only 500 meters from the surface in the seas near Greenland, lives at depths of 1,300 to 1,800 meters or lower in the Bermuda area. After mixing with the South Atlantic water the flow may return northward or be diverted toward the eastern North Atlantic.

A third source of water which may mingle with the flows from north and south already mentioned is the Mediterranean outflow (Text-fig. 1). Although there are no bathypelagic nemerteans in the Mediterranean Sea, the populations in the eastern North Atlantic may be brought into the currents of mixed water as they flow from east to west through the central North Atlantic.

Hence, it may be expected that populations from any or all of these and perhaps from other sources may be found drifting past the Bermuda area in one direction or another whenever a net is lowered to the depth at which each species finds the conditions for survival and reproduction most favorable. But the populations encountered may differ from month to month or even from day to day, although one species, *Nectonemertes mirabilis*, appears to be present at all times. This species is found not only in the Bermuda area but also throughout the North Atlantic and it has also been reported from the South Atlantic. (Text-fig. 1). Hence it is obvious that no matter what may be the direction of the flow at the time of the collection or from whence the water may have come, that species will always be present, either in the net or in the vicinity.

Another species, *Plotonemertes adhaerens*, seems to find the mixed waters of the Bermuda area particularly favorable for reproduction, since a total of 35 representatives of this species has been obtained in that area, while only a single specimen has as yet been found in all the rest of the oceans. It is possible however that the nets used elsewhere were not lowered to the appropriate depth, for this species lives near the lowest limits reached by any of the nets in the Bermuda area. The single specimen known from the middle North Atlantic was likewise taken in the lowest net. Consequently the lowest limit of the population has not been determined.

The fact that in several cases only a single specimen of a species was obtained in a total of more than 600 nets lowered to the depth at which that specimen was found and drawn there horizontally for four hours indicates how sparse must have been the population at those levels and at those times. It may have been only a lucky

chance that brought the net to the exact position occupied at that moment by the nemertean. Or perhaps by an unlucky chance the nets barely missed catching other individuals. At lower levels or at other times it is quite conceivable that the results might have been different.

With a drifting population which may be carried in various directions throughout the vast expanse of the North and South Atlantic oceans, the chances of finding with a one-meter net even a single representative of a species composed of millions of individuals must be very small. It seems highly probable, moreover, that portions of the population may be carried to levels or to regions unfavorable for survival, perhaps too near the surface or to too great depths. These nemerteans, however, in spite of their feeble musculatures, have some capacity for resisting such currents as might tend to carry them above or below the level of their natural habitats. Individuals of *Nectonemertes mirabilis* and *Pelagonemertes rollestoni* have been observed to swim with considerable vigor for a brief period in spite of the great changes in temperature and pressure which they must have endured while being brought from their natural depths to the surface.

The influence of eddies and returning currents may be of great importance in the localization of populations and it is not improbable that there are some regions where a species could remain within a more or less closely circumscribed area indefinitely. From such an endemic area representatives of the species might be carried to distant parts of the ocean, reproducing successive generations on the way.

If the direction and extent of these deep ocean currents were fully known it would be possible to predict the probable distribution of such of the bathypelagic species as inhabit particular water masses. And conversely the distribution of the various species of these nemerteans will doubtless furnish reliable clues as to the extent of the movement of water masses having physical and chemical characteristics to which they are adapted.

If the oceanographers had not already obtained satisfactory evidence of the transfer of South Atlantic water northward across the equator, the known distribution of *Nectonemertes mirabilis* and other species would indicate that the water mass which they inhabit, actually does move across the equator (Text-fig. 1). But since the place of origin of that species is unknown there would be no evidence as to whether the water flows north or south.

With the information now available as to the circulation of the Atlantic water

masses, it is not surprising to find that the species mentioned appears to be distributed all the way from the South Atlantic to the seas east and west of southern Greenland. It has already been found in the South Atlantic west of South Africa, in the equatorial Atlantic, near the West Indies, off the eastern coast of North America, through the width of the North Atlantic to near the coast of Spain and northward to the latitude of southern Greenland. This indicates a range of nearly 100 degrees of latitude, from 34° S. Lat. to 64° N. Lat. (Text-fig. 1).

Protopelagonemertes hubrechtii has likewise been found in the South Atlantic west of South Africa, in the Bermuda area and in the eastern North Atlantic southwest of Ireland. *Crassonemertes robusta* has been reported from the equatorial Atlantic (7° N. Lat.) near the coast of Africa, in the Bermuda area and northwest of Great Britain (58° N. Lat.). These are the only species that have as yet been found both in the tropical or South Atlantic and in the Bermuda area, but it must be remembered that up to the present time relatively few samples of the bathypelagic fauna of the Atlantic between 30° S. Lat. and 30° N. Lat. have been obtained.

Another species with a wide geographical range is *Pelagonemertes rollestoni*, although it has not been found in the Bermuda area nor in any part of the North Atlantic north of 7° N. Lat. This species occurs throughout the entire width of the South Atlantic and it has also been taken in the northern part of the Indian Ocean, as well as far south of Australia. This range covers nearly 180 degrees of longitude and about 55 degrees of latitude. The depth at which the species lives is definitely known, for it has been taken in closing nets at depths between 850 to 1,600 meters (Wheeler, 1934). The great differences in surface temperatures at these far distant regions presumably have little influence on the natural habitat of these worms so far beneath the surface. The general circulation of the water masses at these depths in the southern oceans appears to be such as to aid the distribution of the species from east to west. A northern branch of this circumpolar flow seems to have carried the species northward along the west coast of Africa to a region beyond the equator. (Text-fig. 1).

Only two individuals of *Chuniella lanceolata* are known at present. One of these was found in the Bermuda area and the other in the North Atlantic southwest of Ireland. The former specimen was caught at a depth of about 1,600 meters and the latter at 1,000 meters.

If the collected specimens have been correctly identified, another species with a

wide geographical distribution is *Dinone-mertes investigatoris*, for the type specimen came from the northern Indian Ocean, while two other representatives were taken in the central North Atlantic at Lat. 34° and 48° N. Even if it be assumed that a single population of this species extends at the present time throughout the range indicated, such a population would find essentially uniform conditions in its normal habitat at depths between 1,000 and 2,000 meters in all parts of this wide expanse of oceans. *Nectonemertes minima* has been taken at various localities in the eastern Atlantic oceans, from a point northwest of Ireland, across the equator to near the Cape of Good Hope. This represents a distance of 92 degrees of latitude (57° N. to 35° S.).

As a consequence of this wide circulation of the ocean waters it seems quite possible that all the species of bathypelagic nemerteans that have been found in any part of the North or South Atlantic may at times drift through the Bermuda area. This must likewise be the case with such of the other populations of the bathypelagic faunas as are adapted for drifting along with the currents. Nevertheless Beebe (1937) found that certain populations of fishes in the Bermuda area remained nearly stable for the three successive years when the collections were made. Because of their greater motility, however, the fishes are presumably able to remain in any suitable locality regardless of the movements of the water.

It seems highly improbable, however, that the populations are distributed uniformly over the wide expanse of the oceans between the two or more localities where their representatives have been found. Nor should a species be thought to be restricted to a closely limited area simply because it has been taken at only a single locality. It seems more probable that the populations of one or more species are associated in more or less widely dispersed groups which drift about in the currents or eddies generation after generation as long as the regions to which they are carried offer favorable conditions for existence.

Up to the present time 34 species, representing 21 genera, have been reported from the Atlantic oceans outside the Bermuda area. Only 6 of these have as yet been found within that area and 8 species have been collected in the Bermuda area that have not yet been discovered elsewhere.

This report brings the total number of species reported from the Atlantic oceans to 42, assigned to 10 families and 22 genera, including 14 species, belonging to 12 genera, from the Bermuda area. In addition to these, 15 other species have been collected in the Pacific and Indian oceans, bringing

to 57 the total number of species of bathypelagic nemerteans at present described. Further exploration of the oceans will presumably greatly increase this number, perhaps several fold.

The finding of so many more species in the North Atlantic than in the other oceans should not be considered as valid evidence that they are more abundantly represented in the North Atlantic than elsewhere but that this is merely the result of more intensive exploration. Only 6 species have thus far been found in the Indian Ocean, of which 2 occur also in the Atlantic. None of the 11 species collected in the Pacific Ocean has been found in the Atlantic; the deep waters from one of these two great ocean basins can not circulate directly into the other so far north as those regions in which collections have been made.

In order to facilitate the identification of these species, revised analytical keys are included for all the families of bathypelagic nemerteans and for such genera and species as are known to live in the Atlantic oceans. Most of the species are illustrated by Text-figures and anatomical details of the two new species are shown in Plates I and II.

The distribution of each of the 57 species, in so far as known at the present time, is shown in the following lists.

DISTRIBUTION OF SPECIES.

Distribution of species known to inhabit the North or South Atlantic oceans, or both. Reported from the Bermuda area (B); from other parts of the North Atlantic (N); from the South Atlantic (S); from the Indian Ocean (I).

Family Protopelagonemertidae.

1. *Protopelagonemertes beebeyi*. (B)
2. ——— *hubrechtii*. (B,N,S)
3. *Calonemertes hardyi*. (S)
4. *Plotonemertes adhaerens*. (B,N)
5. ——— *aurantiaca*. (B)
6. *Pendonemertes levensini*. (N)

Family Planktonemertidae.

7. *Planktonemertes vanhoeffeni*. (S)
8. *Mononemertes sargassicola*. (N)
9. ——— *scarlata*. (B)
10. *Crassonemertes robusta*. (B,N)
11. ——— *rhomboidalis*. (N)
12. *Pachynemertes obesa*. (B)

Family Buergeriellidae.

13. *Buergeriella notabilis*. (N)

Family Dinonemertidae.

14. *Paradinonemertes drygalskii*. (N)
15. ——— *wheeleri*. (B)
16. *Dinonemertes alberti*. (N)
17. ——— *grimaldii*. (N)

18. ——— *investigatoris*. (I,N)
19. *Planonemertes labiata*. (B)

Family Phallonemertidae.

20. *Phallonemertes murrayi*. (B,N)

Family Chuniellidae.

21. *Chuniella agassizii*. (N)
22. ——— *elongata*. (N)
23. ——— *lanceolata*. (B,N)

Family Nectonemertidae.

24. *Nectonemertes minima*. (N,S)
25. ——— *mirabilis*. (B,N,S)
26. ——— *primitiva*. (N,S)

Family Armaueriidae.

27. *Armaueria rubra*. (N)

Family Pelagonemertidae.

28. *Natonemertes acutocaudata*. (N)
29. *Gelanemertes richardi*. (N)
30. *Pelagonemertes rollestoni*. (N,S,I)
31. *Parabalaenanemertes fusca*. (N)
32. ——— *nigra*. (B)
33. ——— *zonata*. (N)
34. *Probalaenanemertes irenae*. (S)
35. ——— *wijnhoffi*. (N)

Family Balaenanemertidae.

36. *Balaenanemertes chavesi*. (N)
37. ——— *grandis*. (N)
38. ——— *hjorti*. (N)
39. ——— *lata*. (N)
40. ——— *lobata*. (N)
41. ——— *minor*. (B)
42. (?) ——— *musculocaudata* (=lobata?). (N)

Distribution of species which are not at present known to occur in either the North or South Atlantic Ocean.

Family Planktonemertidae.

- Planktonemertes agassizii* Woodworth, Pacific Ocean.
Mergonemertes woodworthii Bürger, Indian Ocean.
Neuronemertes aurantiaca Coe, Pacific Ocean.

Family Dinonemertidae.

- Dinonemertes mollis* Coe, Pacific Ocean.
Planonemertes lobata Coe, Pacific Ocean.

Family Chuniellidae.

- Chuniella pelagica* Bürger, Indian Ocean.

Family Nectonemertidae.

- Nectonemertes japonica* Foshay, Pacific Ocean.
 ——— *pelagica* Cravens and Heath, Pacific Ocean.

Family Armaueriidae.

- Proarmaueria pellucida* Coe, Pacific Ocean.
Cuneonemertes gracilis Coe, Pacific Ocean.

Family Pelagonemertidae.

Pelagonemertes joubini Coe, Pacific Ocean.

— *moseleyi* Bürger, Pacific Ocean.

— *brinkmanni* Coe, Pacific Ocean.

Nannonemertes indica Wheeler, Indian Ocean.

Family Balaenanemertidae.

Balaenanemertes chuni Bürger, Indian Ocean.

KEY TO FAMILIES.

1. Anterior end of body without tentacles in either sex 2
1. Anterior end of body with pair of tentacles in one or both sexes 9
2. Dorsal blood vessel extends entire length of body 3
2. Dorsal vessel ends blindly in rhynchocoel a short distance posterior to brain Pelagonemertidae
3. Posterior end of body narrow, not differentiated into caudal fin 4
3. Posterior end of body broad and flat, usually terminating in flattened caudal fin 6
4. Musculature of proboscis sheath of interlacing circular and longitudinal fibers Protopelelonemertidae
4. Musculature of proboscis sheath of separate circular and longitudinal layers 5
5. Intestinal diverticula numerous, with few branches and without distinct ventral branch Chuniellidae
5. Intestinal diverticula few, divided repeatedly into numerous slender branches Buegeriellidae
6. Dorsal vessel does not enter rhynchocoel Armaueriidae
6. Dorsal vessel enters rhynchocoel 7
7. Intestinal diverticula with both dorsal and ventral branches, the latter extending laterally beneath the nerve cords Planktonemertidae
7. Intestinal diverticula without distinct ventral branches 8
8. Body broad and flat; spermaries without external phalli Dinonemertidae
8. Body slender; spermaries with external phalli Phallonemertidae
9. Anterior portion of body with pair of lateral tentacles in adult males only; dorsal vessel extends entire length of body Nectonemertidae
9. Head with pair of small lateral tentacles in both sexes; dorsal vessel rudimentary, ending blindly in rhynchocoel Balaenanemertidae

FAMILY

PROTOPELELONEMERTIDAE.

Key to Genera.

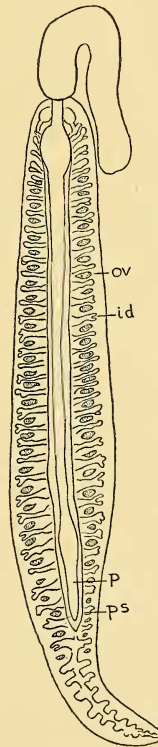
1. Mouth and proboscis opening united; proboscis sheath extends to posterior end of body *Protopelelonemertes*
1. Mouth and proboscis opening separate 2
2. Proboscis sheath about half as long as body; nerve-cord muscles present; glandular adhesive organs absent *Pendonemertes*
2. Proboscis sheath at least three-fourths as long as body 3
3. Proboscis sheath three-fourths as long as body; nerve-cord muscles absent; ventral surface of body with pair of convoluted glandular organs, more highly specialized in the male *Plotonemertes*
3. Proboscis sheath extends to posterior end of body; convoluted glandular organs absent *Calonemertes*

Genus *Protopelelonemertes* Brinkmann.

1. *Protopelelonemertes beebeyi* Coe, 1936.

Text-figure 2.

The only representative of this species as yet known was taken in the Bermuda area at a depth of about 1,646 meters. This was a mature female measuring 24 mm. in length and 7 mm. in width. The color in life



TEXT-FIG. 2. *Protopelelonemertes beebeyi*. Outline of body of female with partially everted proboscis, showing extent of proboscis sheath (ps) and proboscis (p), 30 pairs of ovaries (ov) and 40 pairs of lobed intestinal diverticula (id). (After Coe).

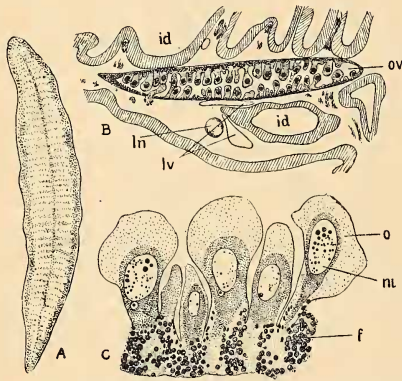
was orange yellow, with paler lateral margins.

2. *Protopelagonemertes hubrechtii* Brinkmann.

Bathynectes hubrechtii Brinkmann, 1912, 1917, 1917a; *Protopelagonemertes hubrechtii* Brinkmann, 1917a Nachtrag; Coe, 1926, 1935, 1936; *Bathynemertes hubrechtii* Wheeler, 1934.

Text-figure 3.

Three representatives of this species were contained in the collection from the Bermuda area reported previously (Coe, 1936). All of these, as well as the type specimen, were females. One additional female measuring 37 mm. long and 6 to 8 mm. wide was found in the supplementary collection. No male has as yet been discovered.



TEXT-FIG. 3. *Protopelagonemertes hubrechtii*. A, typical shape of body; B, ovary (ov); C, portion of ovary showing relation of ova (o) to follicle cells (f); other letters indicate: id, intestinal diverticula; ln, lateral nerve; lv, lateral blood vessel; nu, nucleus. (After Brinkmann).

The depths at which the Bermuda specimens were found ranged from 1,400 to 1,800 meters but inasmuch as one of the 4 specimens was found at the level reached by the lowest net, it is probable that the habitat in the Bermuda area may extend to still greater depths.

The colors in life are described as red, scarlet or orange.

Geographical distribution. In addition to the Bermuda area the species has been reported from the eastern North Atlantic southwest of Ireland, at a depth of 2,000 meters, and from the eastern South Atlantic west of the southern point of Africa at depths of 1,000 meters or less to 2,500 meters or less. One of the specimens from the South Atlantic is known to have been taken at a depth between 1,310 and 1,410 meters.

Genus *Calonemertes*, new genus.

Species of this genus resemble those of *Protopelagonemertes* in general appearance

but differ in having separate openings for mouth and rhynchodeum. Because of these characteristics this new genus must be adopted for the species described by Wheeler (1934) as *Bathynemertes hardyi*.

Body narrowed at both ends, rounded and moderately slender, without indication of lateral or caudal fins; mouth separate from rhynchodeal opening, provided with frilled lips when opened; esophagus absent; proboscis sheath extends entire length of body, musculature of interlaced longitudinal and circular fibers.

3. *Calonemertes hardyi* (Wheeler).

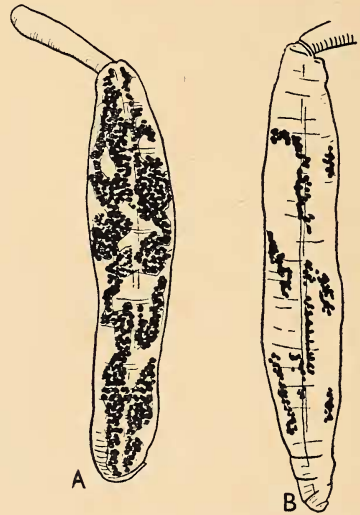
Bathynemertes hardyi Wheeler, 1934.

Text-figure 4.

A single female represents the type of this species. It is one of the largest of all the bathypelagic nemerteans, the type specimen measuring 110 mm. in length, 25 mm. in width and 13 mm. in thickness. This specimen agrees in many respects with the large female described and figured by Coe (1936) as an unusually large individual of *P. hubrechtii* but differs in having separate openings for mouth and rhynchodeum. The body is narrow, rounded and without lateral or caudal fins.

The proboscis sheath extends the entire length of the body and its muscular wall is composed of interlacing longitudinal and circular fibers. The color of the body in life was scarlet with irregular patches of black pigment (Text-fig. 4).

This species is known only from the type specimen which was obtained in an open net lowered to a depth of 1,000 meters and



TEXT-FIG. 4. *Calonemertes hardyi*. Outlines of body from ventral (A) and dorsal (B) surfaces, showing the irregular patches of black pigment. (After Wheeler).

drawn to the surface. The locality was in the eastern South Atlantic west of the Cape of Good Hope.

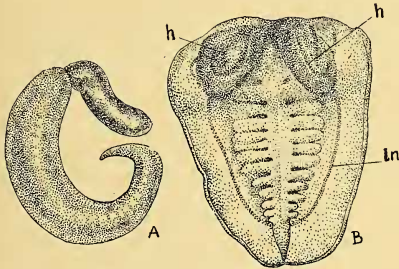
Genus *Plotonemertes* Brinkmann.

4. *Plotonemertes adhaerens* Brinkmann, 1917.

Text-figure 5.

P. adhaerens Brinkmann, 1917, 1917a; Coe, 1926, 1935, 1936.

In addition to the 27 specimens previously reported from the Bermuda area (Coe, 1935, 1936), the present collections contained 8 individuals, representing both sexes. These varied in length from 8 to 16 mm. One specimen was taken at a depth of about 1,100 m., 5 from a depth of 1,500 m. and two from 1,800 m.



TEXT-FIG. 5. *Plotonemertes adhaerens*. A, type specimen with everted proboscis; B, ventral surface of posterior end of body, showing pair of glandular organs (h) and lateral nerves (ln). (After Brinkmann).

The 27 specimens included in the earlier report (Coe, 1936) came from depths of 1,300 to 1,830 m. Since none of the nets was lowered below 1,830 m., it seems possible that the species may also inhabit somewhat greater depths in that region. The type specimen came from about 2,000 m. The number of individuals caught increases with depth from 1,100 to 1,600 m. and then diminishes with increasing depths to 2,000 m. Hence the optimum depth of the species in the Bermuda area would seem to be about 1,600 m.

With the exception of *Nectonemertes mirabilis*, this was the most abundant bathypelagic nemertean in the Bermuda area between the depths of 1,100 and 1,830 m. at the times when these collections were made. It was not taken in any of the nets drawn at higher levels. Only a single specimen has been found in any other part of the ocean and this was collected near the middle of the North Atlantic (47°34' N. Lat., 43°11' W. Long.).

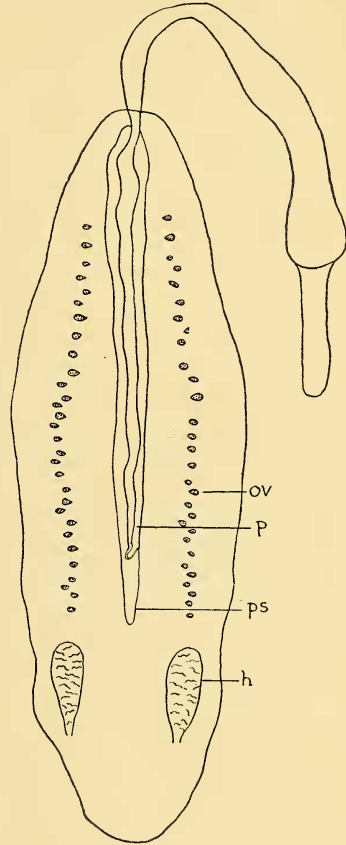
Mature individuals of both sexes vary from 12 to 30 mm. in length and 2 to 9 mm. in width. The colors in life are reported as pink, pinkish-orange, orange and red. De-

tailed descriptions and figures of the organ systems may be found in the papers by Brinkmann (1917a) and Coe (1936).

5. *Plotonemertes aurantiaca* Coe, 1936.

Text-figure 6.

Only the type specimen of this species is known at present. This was a mature female 40 mm. in length, 11 mm. in width and 5 to 7 mm. in thickness. The color in life was bright orange, with yellow margins, caudal fin and proboscis. It was taken in the Bermuda area at a depth of about 1,463 meters.



TEXT-FIG. 6. *Plotonemertes aurantiaca*, ventral surface of body of female, showing pair of glandular organs (h), ovaries (ov), extent of proboscis sheath (ps), and attachment of proboscis (p). (After Coe).

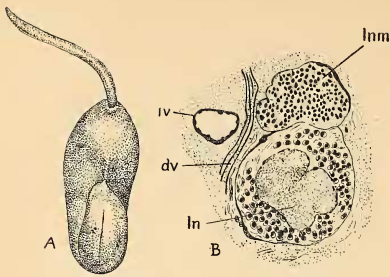
Genus *Pendonemertes* Brinkmann.

6. *Pendonemertes levensini* Brinkmann, 1917.

P. levensini Coe, 1926.

Text-figure 7.

The three known representatives of this species were taken in the eastern North Atlantic (Lat. 35° to 50° N., Long. 7° to



TEXT-FIG. 7. *Pendonemertes levensini*. **A**, female from ventral surface; **B**, transverse section of lateral nerve cord (ln) with accompanying nerve-cord muscle (lnm), lateral blood vessel (lv) and dorsoventral muscles (dv). (After Brinkmann).

11° W.) at depths of 1,000 to 2,260 meters. All were females.

FAMILY PLANKTONEMERTIDAE.

Key to Genera Known to Occur in the Atlantic Oceans.

- 1. Mouth and proboscis united into a short atrium 2
- 1. Mouth and proboscis opening separate 3
- 2. Body broad and flat without distinct caudal fin *Planktonemertes*
- 2. Body broad in middle third, narrowed at both ends, with caudal fin
Mononemertes
- 3. Body short, broad and thick; caudal fin narrow and sharply demarcated from body; intestinal diverticula much divided, with well-developed ventral branches *Crassonemertes*
- 3. Caudal fin slightly differentiated; intestinal diverticula without ventral branches *Pachynemertes*

Genus *Planktonemertes* Woodworth.

7. *Planktonemertes vanhoeffeni* Brinkmann.

P. vanhoeffeni Brinkmann, 1915, 1917, 1917a; Coe, 1926.
Text-figure 8.

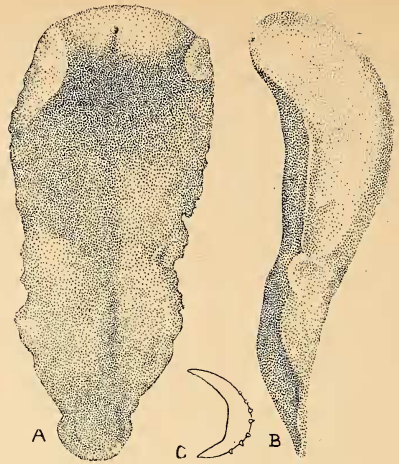
Known only from a single female collected by the German South Polar expedition in a net drawn from a depth of 3,000 meters to the surface in the South Atlantic Ocean west of the Cape of Good Hope.

Genus *Mononemertes* Coe.

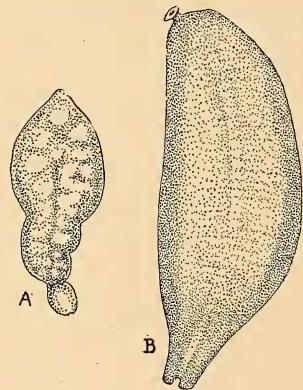
8. *Mononemertes sargassicola* (Joubin).

Planktonemertes sargassicola Joubin, 1906;
Mononemertes sargassicola Coe, 1926.
Text-figure 9, A.

Known only from a single specimen collected in a net drawn from a depth of 2,225



TEXT-FIG. 8. *Planktonemertes vanhoeffeni* **A**, **B**, type specimen from dorsal and lateral surfaces respectively; **C**, stilet basis. (After Brinkmann).



TEXT-FIG. 9. **A**, *Mononemertes sargassicola* (after Joubin); **B**, *Crassonemertes robusta* (after Brinkmann).

meters to the surface by the Prince of Monaco expedition in the Sargasso Sea (Lat. 27°36' N., Long. 38°29' W.). The internal anatomy has not as yet been described.

9. *Mononemertes scarlata* new species.

Plate I, figures 1-8.

The type specimen of this new species was somewhat similar to that of *Planktonemertes vanhoeffeni* morphologically but differed in shape of body, in having a caudal fin, in having a dorsal core in each of the lateral nerve cords, in a less sharply curved stilet basis, in number of proboscicidal nerves, and in other morphological details.

Body short and broad; oval in outline

and rather thin; narrowed posteriorly to form a thin caudal fin which is not sharply demarcated from body (Pl. I, fig. 1).

Length of type specimen, which represents a nearly sexually mature male, 15 mm., width 9 mm., thickness 2 to 3 mm. Color in life scarlet.

Body walls. Musculature of body wall thin, the longitudinal muscles being arranged in separated bands. Although the body is provided with a caudal fin, the reduction of the musculatures indicates an inability for rapid movements. Because of the low specific gravity due to the high water content of the tissues, slight undulatory movements would be sufficient to keep the body suspended. Dorsoventral muscles are present in each of the interdiverticular spaces but are highly developed only in the caudal fin (Pl. I, fig. 1). The surface epithelium remained in place only on the ventral side in the posterior fourth of the body. Where present, it is composed of slender ciliated and glandular cells and is somewhat greater in thickness than that of the musculatures and basement layer combined (Pl. I, fig. 4).

Proboscis sheath. Mouth and proboscis opening united into a short atrium when proboscis lies in natural position in body (Pl. I, figs. 1, 2). Proboscis sheath about seven-eighths as long as body, terminating at base of caudal fin. Musculature of proboscis sheath composed of interlacing longitudinal and circular or spiral fibers but with some indication of a three-layered condition, since many of the circular fibers form incomplete outer and inner layers with most of the longitudinal fibers between them (Pl. I, fig. 5).

Proboscis large but less than twice as long as the body, loosely coiled in rhynchocoel. Posterior chamber short, with a short retractor attached by means of interlacing muscular fibers to the dorsal wall of sheath near posterior end of latter. There were in the type specimen 17 distinct proboscoidal nerves, with several additional enlargements of the intermuscular nervous plexus in the anterior portion of the organ, where the number may appear to be 20 or 21. The armature consists of the usual form of curved basis, asymmetrically crescentic in optical section, with perhaps 20 or more small pits from which, in this specimen, the minute stylets had been dissolved (Pl. I, fig. 7). Accessory stylet pouches were not found.

Digestive system. The mouth opens from the atrium directly into the stomach, the esophagus being absent as in some other bathypelagic species. The walls of the stomach are folded in such a manner as to indicate that they may be everted from the

atrium to serve as lips to hold the prey at the time of feeding (Pl. I, fig. 2). The pylorus is short, with a correspondingly short caecum but the number of pairs of caecal diverticula could not be determined. There were in the type specimen about 40 pairs of intestinal diverticula, each with a broadly lobed but not profusely divided dorsal branch and a similar, but somewhat smaller ventral branch between the nerve cord and the body wall (Pl. I, fig. 3). The ventral branches become smaller posteriorly and disappear anterior to the caudal fin, allowing the nerve cord to come in contact with the ventral body wall (Pl. I, fig. 4).

Blood-vascular system. Lateral and dorsal vessels as in related genera. Dorsal vessel enters anterior end of rhynchocoel and remains on the ventral wall of this cavity throughout the length of the pylorus region; it then leaves the rhynchocoel and continues posteriorly on the ventral side of the proboscis sheath to the posterior end of that organ. Posterior to the proboscis sheath the dorsal vessel lies beneath the dorsal body wall and joins the lateral vessels in the caudal fin.

Nervous system. Lateral nerve cords with large ventral fibrous core and a much smaller and rather inconspicuous dorsal core (Pl. I, fig. 8).

Reproductive organs. The type specimen was a nearly mature male with 8 pairs of spermaries near the anterior end of the body (Pl. I, fig. 1). They are situated near the ventral sides of the nerve cords, the most anterior ones being close behind the brain. From each spermary a small spermatid duct leads to the ventral surface of the body.

Geographical distribution. This new species is as yet known only from a single individual collected in the Bermuda area at a depth of about 1,500 meters.

Type Specimen: Holotype, Cat. No. 31247; Net 1025; June 16, 1931. In the collections of the Department of Tropical Research, New York Zoological Park, New York City.

Genus *Crassonemertes* Brinkmann.

10. *Crassonemertes* (?) *rhomboidalis*
(Joubin).

Planktonemertes rhomboidalis Joubin,
1906; *C. (?) rhomboidalis* Coe, 1926.

This species was described from the external appearance of the body only, and nothing is as yet known as to the internal morphology. Consequently the status of the species must remain doubtful until a more complete study of the type specimen is made. The specimen was collected in the Sargasso Sea in a net drawn from 2,000 meters to the surface.

11. *Crassonemertes robusta* Brinkmann.

Text-figure 9,B.

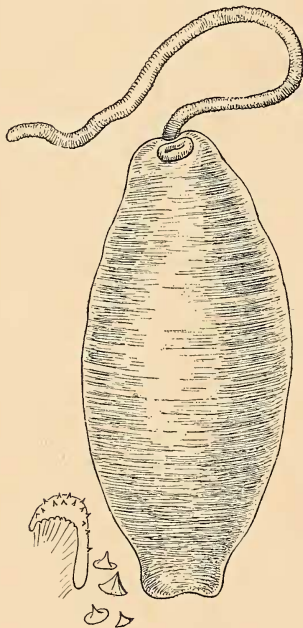
Brinkmann, 1917, 1917a; Coe, 1926, 1936; Wheeler, 1934.

This species is known from 3 specimens; 2 of these were females, while the sexuality of the other could not be determined. Hence the male remains undescribed. The type specimen was collected in the North Atlantic, northwest of Great Britain (Lat. 57°41' N., Long. 11°48' W.) at a depth of about 1,666 meters; the second came from the Bermuda area at a depth of 1,100 meters and the third from off the west coast of Africa (Lat. 6°55' N., Long. 15°54' W.). This distribution appears to cover a triangular area across the width of the North Atlantic and extends through more than 50 degrees of latitude. It is not known, however, whether the species occurs at intermediate localities but the ocean currents are such as to make a wide distribution probable (Text-fig. 1).

Genus *Pachynemertes* Coe.12. *Pachynemertes obesa* Coe, 1936.

Text-figure 10.

Known only from the type specimen measuring 16 mm. in length, 8 mm. in width and 5 mm. in thickness. This was a mature female collected in the Bermuda area at a depth of about 1,600 meters.



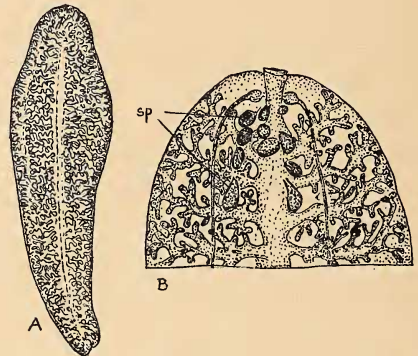
TEXT-FIG. 10. *Pachynemertes obesa*. Strongly contracted specimen, showing mouth and everted proboscis; also stylet basis and several stylets. (After Coe).

FAMILY BUERGERIELLIDAE.

Genus *Buergeriella* Brinkmann.13. *Buergeriella notabilis* Brinkmann, 1917.*B. notabilis* Brinkmann, 1917a; Coe, 1926.

Text-figure 11.

Only a single representative of this species is at present known. This was a male 52 mm. in length, 15 mm. in greatest width and only 2.5 to 4 mm. in thickness. This was collected in the North Atlantic (Lat 48° 29' N., Long. 13° 55' W.) at a depth of 1,333 meters.



TEXT-FIG. 11. *Buergeriella notabilis*. A, type specimen, showing profusely branched intestinal diverticula; B, anterior end of body, showing spermaries (sp). (After Brinkmann).

FAMILY DINONEMERTIDAE.

Key to Genera at Present Known from the Atlantic Oceans.

1. Mouth on ventral surface of head, well separated from rhynchodeal opening; proboscis sheath almost as long as body; wall of sheath of interwoven longitudinal and circular fibers

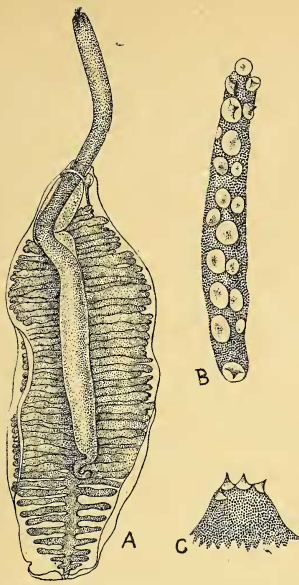
Paradinonemertes

1. Mouth anterior to brain; wall of proboscis sheath composed of separate muscular layers 2
2. Proboscis sheath limited to anterior two-thirds of body.....*Dinonemertes*
2. Proboscis sheath nearly as long as body*Planonemertes*

Genus *Paradinonemertes* Brinkmann.14. *Paradinonemertes drygalskii* Brinkmann.*P. drygalskii* Brinkmann, 1915, 1917; Coe, 1926.

Text-figure 12.

Two representatives of this species, both of which were males, were taken by the *Michael Sars* expedition in the North Atlantic west of the Cape Verde Islands (Lat. 17°28' N., Long. 29°42' W.) in a net drawn from a depth of 3,000 meters to the surface.



TEXT-FIG. 12. *Paradinemertes drygalskii*. **A**, outline of body, showing unbranched intestinal diverticula and extent of proboscis sheath; **B**, stylet basis; **C**, transverse section of basis with stylets. (After Brinkmann).

15. *Paradinemertes wheeleri* Coe, 1936.

Text-figure 13.

Six individuals belonging to this species were obtained in the Bermuda area. The body is broad, flat and thin, with broad caudal fin not sharply demarcated from body. The length of these specimens varied from 11 to 42 mm. and the width from 4 to 15 mm. The males have 3 to 5 spermaries in an irregular row on each side of the body close behind the brain and mature females 30 to 36 pairs of ovaries.

This species is known only from the Bermuda area, where it was found to live at depths of 1,400 to 1,800 meters.

Genus *Dinonemertes* Laidlaw.

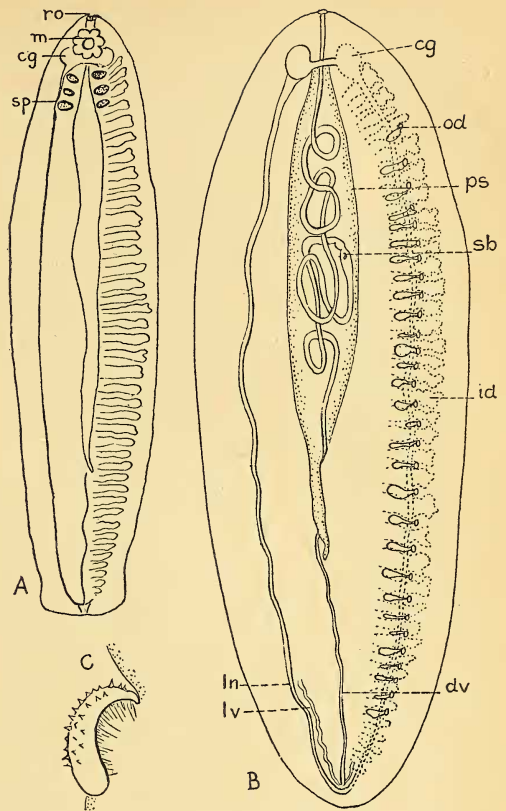
16. *Dinonemertes alberti* (Joubin).

Planktonemertes alberti Joubin, 1906;
D. alberti Brinkmann, 1917; Coe, 1926.

Text-figure 14,A.

In this, as in other species of the genus, the body is broad, flat and thin, with nearly parallel lateral margins. The type specimen was 85 mm. long and 27 mm. wide, while the three other individuals which have thus far been collected were from 66.5 to 76 mm. in length and from 19 to 22 mm. in width.

The male, as figured by Joubin, has a row of 6 or more closely placed spermaries on each side of the body back of the brain. The females have 18 to 25 pairs of ovaries.



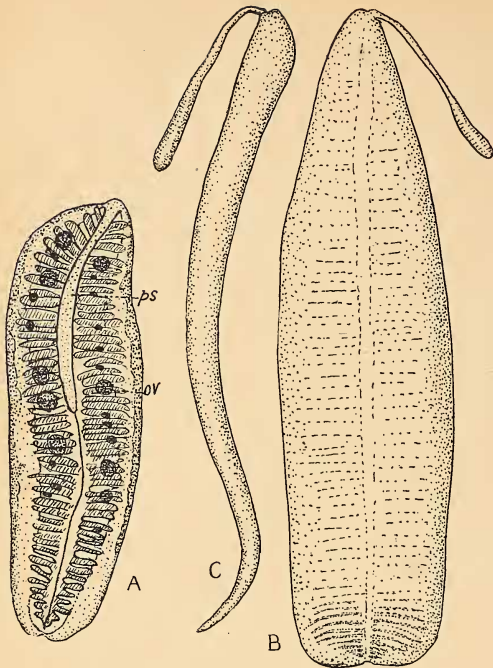
TEXT-FIG. 13. *Paradinemertes wheeleri*. **A**, male with 3 pairs of spermaries (**sp**); **B**, female with 30 pairs of ovaries and oviducts (**od**); other letters indicate: **cg**, cerebral ganglia; **dv**, dorsal vessel; **id**, intestinal diverticula; **lv**, lateral vessel; **m**, mouth; **ps**, proboscis sheath; **ro**, rhynchodeal opening; **sb**, stylet basis of proboscis; **C**, stylet basis with minute stylets. (After Coe).

This species has been found only in the northern part of the North Atlantic (Lat. 63° to 71° N.), between Greenland and Norway. The nets were lowered to depths of 1,300 to 3,300 meters and drawn to the surface.

17. *Dinonemertes grimaldii* (Joubin).

Planktonemertes grimaldii Joubin, 1906;
D. grimaldii Brinkmann, 1917; Coe, 1926.

The two specimens, each about 40 mm. long and 10 mm. wide, which Joubin considered as representing a species distinct from *D. alberti*, have as yet been studied only superficially. Until the essential features of the internal anatomy are known the status of the species must remain in doubt. The specimens were collected in the middle North Atlantic (Lat. 31° to 37° N.) between 3,000 meters and the surface.



Joubin; **B, C**, after Brinkmann). showing intestinal diverticula, ovaries (**ov**) and short proboscis sheath (**ps**). **B, C**, dorsal and lateral views of *D. investigatoris*. (**A** after Joubin; **B, C**, after Brinkmann).

18. *Dinonemertes investigatoris* Laidlaw, 1906. *D. investigatoris* Brinkmann, 1917, 1917a; Coe, 1926.

Text-figure 14,B,C.

Individuals of this species are the giants among the bathypelagic nemerteans, the broad and flat body of the three specimens thus far obtained measuring from 107 to 203 mm. in length and 23 to 56 mm. in width. All were mature females.

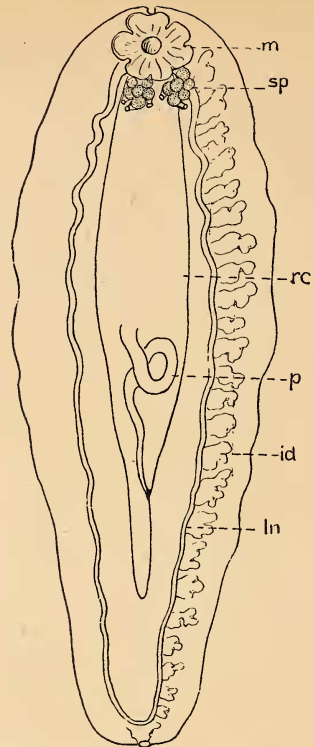
The type specimen was taken from a depth of about 2,000 meters in the Indian Ocean, southwest of India. Two other specimens which Brinkmann (1917) referred to this species were collected in the middle North Atlantic (Lat. 34° and 48°) in nets lowered to 2,000 meters. If Brinkmann was correct in his identification, this species has a wider geographical range than is known for any other bathypelagic nemertean, with the exception of *Pelagonemertes rollestoni*. No examples have as yet been found at intermediate stations. Only these two species have been collected both in the Indian Ocean and in the North Atlantic.

Genus *Planonemertes* Coe.

19. *Planonemertes labiata* Coe, 1936.

Text-figure 15.

This species is known only from the Ber-



TEXT-FIG. 15. *Planonemertes labiata*. Outline of body of male, showing spermaries (**sp**), extent of rhynchocoel (**rc**) with posterior attachment of proboscis (**p**), lobed intestinal diverticula (**id**), mouth with everted lips (**m**) and lateral nerve cord (**ln**). (After Coe).

muda area, where two individuals, one male and one female, were taken at a depth of about 1,800 meters.

FAMILY PHALLONEMERTIDAE.

Genus *Phallonemertes* Brinkmann.

20. *Phallonemertes murrayi* (Brinkmann).

Bathynectes murrayi Brinkmann, 1912, 1917, 1917a; *P. murrayi* Brinkmann, 1917; Coe, 1926, 1936.

Text-figure 16.

Two specimens of this species were taken in the Bermuda area at depths of 1,500 and 1,800 meters. Previously reported from various localities in the North Atlantic from Lat. 35° N. to near the southern point of Greenland at depths of 1,600 to 2,000 meters.

FAMILY CHUNIPELLIDAE.

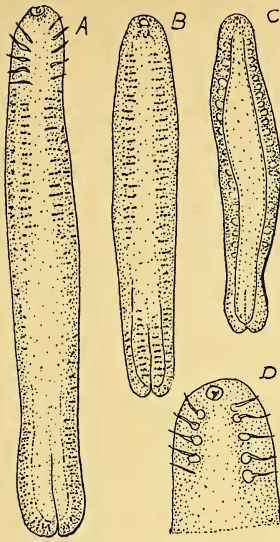
Genus *Chuniella* Brinkmann.

21. *Chuniella agassizii* (Bürger).

Planktonemertes agassizii Bürger, 1909; *C. agassizii* Brinkmann, 1917; Coe, 1926.

Text-figure 17, B, C.

The single known representative of this



TEXT-FIG. 16. *Phallonemertes murrayi*. A, D, males with external, tubular genital papillae; B, C, females. (After Brinkmann).

species was an immature female collected in the equatorial Atlantic (Lat. 9°N.) off the coast of Sierra Leone, Africa, in a net drawn from a depth of 1,300 meters.

22. *Chuniella* (?) *elongata* (Joubin).

Planktonemertes elongata Joubin, 1906; *C. (?) elongata* Brinkmann, 1917; Coe, 1926.

As only the type specimen is known and this has been described only superficially, the status of this species still remains in doubt. The specimen was taken near the middle of the North Atlantic (Lat. 34° N.) in a net drawn from 4,000 meters to the surface.

23. *Chuniella lanceolata* Brinkmann, 1917.

C. lanceolata Coe, 1926.

Text-figure 17, A.

Only two specimens of this species have been discovered up to the present time. One of these was a female taken at a depth of about 1,600 meters in the Bermuda area, while the type specimen was a male collected in the North Atlantic (Lat. 48° 29' N.) southwest of Ireland in a net lowered to only 1,000 meters.

FAMILY NECTONEMERTIDAE.

Genus *Nectonemertes* Verrill.

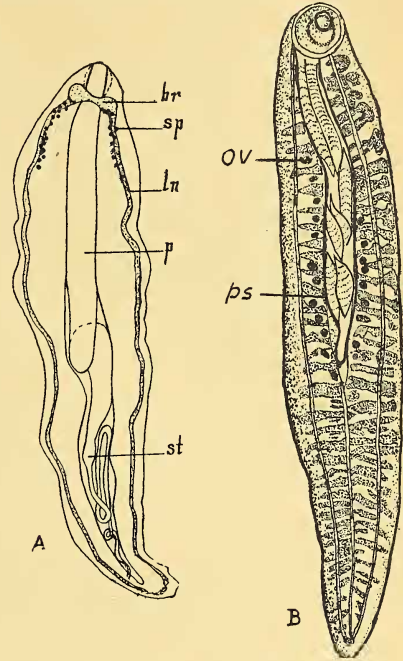
24. *Nectonemertes minima* Brinkmann, 1915.

Hyalonemertes atlantica Bürger, 1909; *N. minima* Brinkmann, 1917, 1917a; Coe, 1926.

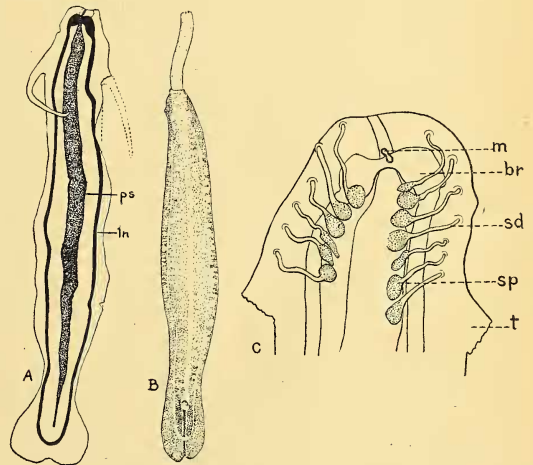
Text-figure 18.

This species is widely distributed in the

eastern North and South Atlantic oceans from 57° north latitude to 35° south latitude. This range of 92 degrees of latitude extends from a point northwest of Ireland,



TEXT-FIG. 17. A, *Chuniella lanceolata*, male showing spermaries (sp) in an irregular row behind the brain (br), the long proboscis (p) with stylet chamber (st) and the lateral nerve cords (ln). B, C, *agassizii*, female with ovaries (ov) and short proboscis sheath (ps). (A after Brinkmann, B after Bürger).



TEXT-FIG. 18. *Nectonemertes minima*. A, outline of body of male; B, female; C, anterior end of body of male, showing position of spermaries (sp); other letters indicate: br, brain; ln, lateral nerve cord; m, mouth; ps, proboscis sheath; sd, sperm duct; t, base of tentacle. (After Brinkmann).

across the equator to near the Cape of Good Hope.

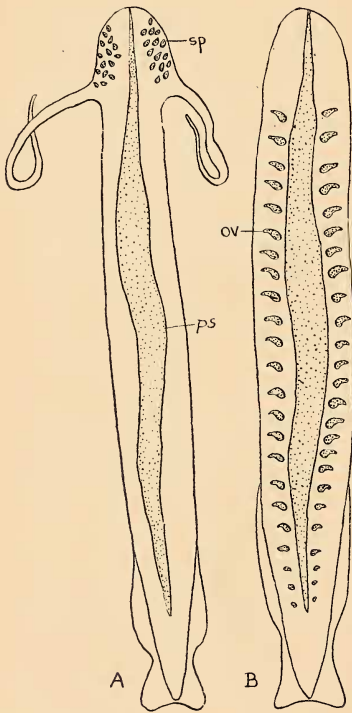
The males are distinguished from those of *N. mirabilis* and *N. primitiva* in having 5 to 7 spermaries on each side of the body back of the head. The female has about 25 pairs of ovaries.

25. *Nectonemertes mirabilis* Verrill.

N. mirabilis (*Hyalonemertes atlantica*) Verrill, 1892; Brinkmann, 1917, 1917a; Coe and Ball, 1920; Coe, 1926, 1936; Wheeler, 1934; *N. grimaldii* Joubin, 1904, 1906; *N. kempfi* (?) Wheeler, 1934.

Text-figure 19.

The collections previously reported from the Bermuda area (Coe, 1935, 1936) contained 32 representatives of this species. The supplementary collections from the same area included 12 additional specimens. These represented both sexes and various stages of sexual maturity. One of these was caught at a depth of about 1,100 meters, 6 at 1,300 m., 2 at 1,460 m., 1 at 1,640 m. and 2 at 1,830 m.



TEXT-FIG. 19. *Nectonemertes mirabilis*. **A**, male with cephalic spermaries (**sp**); **B**, female with 23 pairs of ovaries (**ov**); **ps**, proboscis sheath.

The 32 specimens of this species previously obtained from this area came from depths of 900 to 1,830 meters, with the largest numbers coming from near the maxi-

mum depth. Consequently it may be surmised that the species might also have been found if the nets had been lowered to somewhat deeper levels. The range is from 500 to 2,000 meters but the greater portion of population seems to be limited to a rather definite water layer having a temperature of 3.5° to 5° C. and a salinity of about 3.5 per cent. This layer is found at a depth of 1,200 to 2,000 meters in the Bermuda area but is nearer the surface in the northern part of the North Atlantic. There the species is found at a correspondingly higher level.

This species has a wide range of geographical distribution, being found throughout the North Atlantic Ocean from near Cuba to the latitude of southern Greenland and from the American to the European continental slopes. It also extends southward through the tropics to the South Atlantic in the latitude of South Africa (Text-fig. 1). It appears to be by far the most abundant of all the bathypelagic nemerteans which up to the present time have been discovered in the North Atlantic Ocean.

The morphological characteristics of this species have been described in detail by Coe and Ball (1920). The colors of the females in life are described as yellow or orange and of the males red or scarlet. The young are paler, sometimes white.

Wheeler (1934) reported from the eastern equatorial Atlantic (Lat. 7° N., Long. 16° W.) a specimen which he supposed to represent a new species which he described as *N. kempfi*. There is nothing in his description, however, which does not apply equally well to young individuals of *N. mirabilis*. Therefore there seems to be no good reason for considering *N. kempfi* to be a valid species.

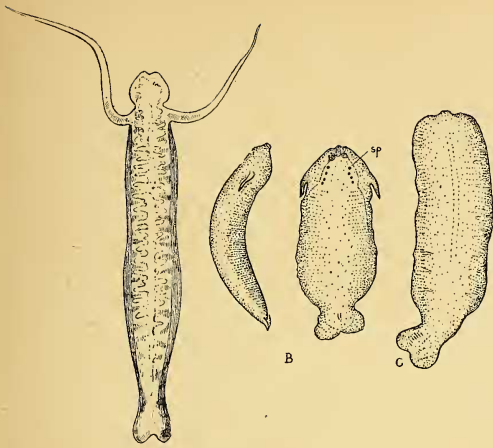
26. *Nectonemertes primitiva* Brinkmann, 1917, 1917a.

N. primitiva Coe, 1926; *Nectonemertes mirabilis* Bürger, 1909.

Text-figure 20.

One of the three known representatives of this species was taken in the equatorial Atlantic (Lat. 3°55' S., Long. 7°48' W.) off the west coast of French Congo in a vertical haul from 3,000 meters; the other two come from the central North Atlantic (Lat. 31° N., Long. 35° W. and Lat. 35° N., 33° W.) at depths of 665 and 2,000 meters respectively.

The male is distinguished from that of *N. mirabilis* in having a single row of 4 to 6 spermaries on each side of the body close behind the brain (Text-fig. 20), while the female has about 10 pairs of ovaries.



TEXT-FIG. 20. *Nectonemertes primitiva*. **A**, outline of body of living individual, with slender body and tentacles (after Bürger). **B**, lateral and ventral views of male with body contracted after preservation; **sp**, spermaries; **C**, female (after Brinkmann).

FAMILY ARMAUERIIDAE.

Genus *Armaueria* Brinkmann.

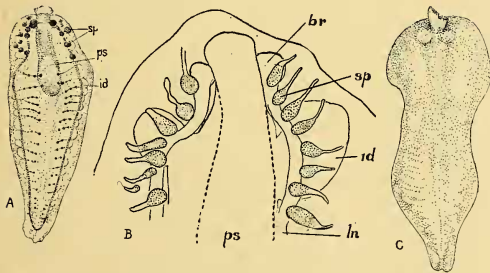
27. *Armaueria rubra* Brinkmann, 1917.

A. rubra Coe, 1926.

Text-figure 21.

Individuals of this species are small, even when sexually mature, the four known representatives being only 5.3 to 9.5 mm. in length and 2 to 7 mm. in width. The proboscis sheath is limited to the anterior half of the body (Text-fig. 21). The male has 8 to 12 spermaries in an irregular row on each side of the body close behind the brain (Text-fig. 21), while the single female at present known has 8 pairs of ovaries.

Known only from the central North At-



TEXT-FIG. 21. *Armaueria rubra*. **A**, male, showing spermaries (**sp**) and short proboscis sheath (**ps**); **B**, anterior end of body of male, showing position of spermaries (**sp**) relative to brain (**br**); **C**, female, showing dorsal position of rhynchodeal opening; other letters indicate: **id**, caecal diverticulum; **ln**, lateral nerve cord. (After Brinkmann).

lantic (Lat. 45° to 55° N., Long. 25° to 43° W.), where four specimens were collected at depths of 800 to 1,600 meters.

FAMILY PELAGONEMERTIDAE.

Key to Genera Found in the Atlantic Oceans.

1. Body pointed at posterior end, without caudal fin 2
1. Body with more or less well demarcated caudal fin 3
2. Spermaries in a single row on each side of body near brain *Gelanemertes*
2. Spermaries in a compact group on each side of body near brain *Natonemertes*
3. Caudal fin not distinctly demarcated..... *Parabalaenanemertes*
3. Caudal fin well developed 4
4. Intestinal diverticula closely appressed *Probalaenanemertes*
4. Intestinal diverticula separated by much gelatinous tissue..... *Pelagonemertes*

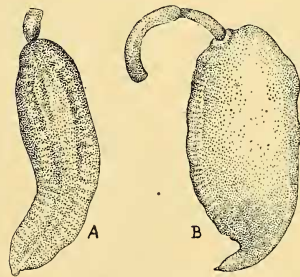
Genus *Natonemertes* Brinkmann.

28. *Natonemertes acutocaudata* Brinkmann, 1917.

N. acutocaudata Coe, 1926.

Text-figure 22.

Only two representatives of this species are at present known. Both were males with a compact group of four or five spermaries on each side immediately posterior to the brain. They were collected in the northern part of the North Atlantic (Lat. 58° to 61° N., Long. 12° to 17° W.) in a net lowered to depths of 1,200 to 1,400 meters.



TEXT-FIG. 22. *Natonemertes acutocaudata* in different states of contraction. (After Brinkmann).

Genus *Gelanemertes* Coe.

29. *Gelanemertes richardi* (Joubin).

Pelagonemertes richardi Joubin, 1906; *G. richardi* Coe, 1926.

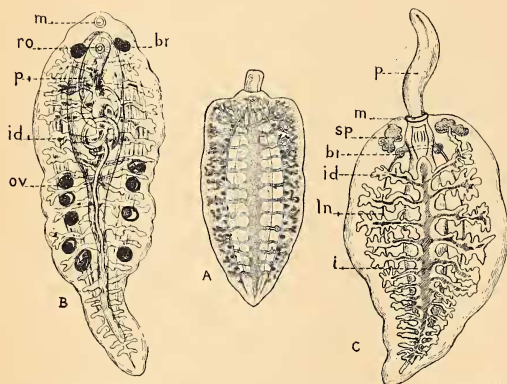
The single known representative of this species has not yet been studied sufficiently

to determine the details of the internal anatomy. The general appearance of the body resembles that of species of *Pelagonemertes* but indicates a different genus because the spermaries are situated in a single row on each side of the body. This specimen was taken in the central North Atlantic (Lat. 30°36' N., Long. 26°05' W.).

Genus *Pelagonemertes* Moseley, 1875.

30. *Pelagonemertes rollestoni* Bürger, 1909;
Brinkmann, 1915, 1917; Coe, 1926;
Wheeler, 1934.
Text-fig. 23.

This appears to be one of the most abundant as well as the most widely distributed of all the bathypelagic species. It has been taken in the equatorial Atlantic (Lat. 0° N., Long. 7° W.) off the west coast of Africa, across almost the entire width of the South Atlantic at 30° to 50° of latitude, near Ceylon in the Indian Ocean (Lat. 5° N.) and in the ocean far south of Australia (Lat. 50° S., 123° W.) This indicates a range of 55 degrees of latitude and 130 degrees of longitude. Some of the specimens were taken in closing nets at depths of 700 to 950 meters, while the others were caught in open nets lowered to depths of 1,000 to 3,500 meters.



TEXT-FIG. 23. *Pelagonemertes rollestoni*. A, female with 13 pairs of small ovaries (after Moseley). B, female; C, male (after Bürger). Letters indicate: br, brain; i, intestine; id, intestinal diverticula; ln, lateral nerve cord; m, mouth; ov, ovaries; p, proboscis; ro, rhynchodeal opening; sp, spermaries.

Genus *Parabalaenanemertes* Brinkmann.

31. *Parabalaenanemertes fusca* Brinkmann,
1917.
P. fusca Coe, 1926.

The three known specimens, one male and two females, were taken in the northern part of the central North Atlantic (Lat. 46° to 55° N., Long. 7° to 28° W.) at depths of 650 to 1,800 meters.

32. *Parabalaenanemertes nigra*, new species.

Plate II, figs. 1-5.

One female which evidently represents a new species of this genus was found among the collections made in 1931. This specimen resembled in many respects the corresponding sex of *P. fusca* as described by Brinkmann (1917) but when sectioned was found to differ in having but a single fibrous core in each of the lateral nerve cords, in having an almost complete lack of dorsoventral muscular fibers even in the posterior end of the body, in having both dorsal and ventral branches of the intestinal diverticula profusely branched, in a much larger and longer proboscis, in having the long posterior chamber of the proboscis deeply pigmented and in other details.

This specimen was small, although it was sexually mature. The body was oval in shape, narrowed at both ends but more slender posteriorly and only slightly flattened (Pl. II, fig. 1). It measured 7 mm. in length, 3 mm. in greatest width and 2 mm. in thickness. It should be mentioned that one of the females of *P. fusca* studied by Brinkmann was of exactly the same dimensions.

Color. The specimen was labeled by the collector "black worm," presumably as an indication of the color in life. After preservation for ten years, however, the color had mostly disappeared except for the intensely black pigmentation of the long posterior chamber of the proboscis. There remained also some traces of the original pigment in the granular contents of the intestinal diverticula.

Body walls. The musculature of the body walls is remarkably thin, especially toward the lateral margins of the body. The basement layer which in life supports the surface epithelium is likewise much thinner than in most bathypelagic nemerteans but it has the usual cup-like depressions to allow for the firm attachment of the epithelial cells. As so often happens with these worms, most of the epithelium was lost at the time of collection.

Proboscis sheath. The rhynchodeum opens at the tip of the head, immediately dorsal to the mouth. The proboscis sheath extends the entire length of the body and is so large that it occupies about three-fourths the vertical axis of the body in the median line and about one-third the width of the body. Its musculature is generally three to six times as thick as that of the body wall and is arranged in two distinct layers. Of these the outer is spiral and the inner longitudinal. The spiral layer is about twice as thick as the longitudinal layer and both are

considerably thinner along the ventral side than elsewhere (Pl. II, fig. 3).

At the anterior end of the sheath, in the brain region, the muscular layers are more or less distinctly reversed, the separated bundles of longitudinal muscles being bordered internally by a layer of circular muscles and externally by a thin layer of spiral fibers. For a short distance posterior to the brain region the spiral and longitudinal bundles are interlaced but in the region of the foregut the longitudinal fibers become separated into a distinct internal layer. That relation of the two layers continues throughout the rest of the body.

Through the anterior four-fifths of the body the sheath remains nearly uniform in diameter, the rhynchocoel being nearly filled with the three loops of the proboscis. The sheath then becomes somewhat enlarged to accommodate the many loops of the posterior chamber of the proboscis (Pl. II, fig. 1). The terminal portion of the sheath is narrowly constricted but the musculatures remain thick enough to allow a firm attachment for the interlacing fibers of the proboscis retractor muscles.

Proboscis. This organ is much larger than in most bathypelagic species and with its long retractor measures between four and five times the length of the body. In this type specimen, although the proboscis was partially everted at the time of preservation, it remains in three longitudinal loops, each of which is nearly as long as the body (Pl. II, fig. 1). The narrowed posterior end of the sheath retains its thick, two-layered walls and the long retractor is interlaced with the musculature of the dorsal wall (Pl. II, fig. 1).

The middle chamber is provided with a curved, spoon-shaped basis which in life must have borne a dozen or more stylets, but the latter had been dissolved in the preserved specimen. Accessory stylets were also missing. There are 12 large proboscical nerves which occupy the usual positions in the distal portion of the longitudinal muscular layer. The external and internal circular musculatures are relatively thin.

The posterior chamber of the proboscis is itself longer than the body, being looped back on itself repeatedly in the widened posterior portion of the sheath (Pl. II, fig. 1). In a single transverse section of the body there were as many as nine sections of these loops. The epithelial cells of this portion of the proboscis form an intensely black secretion which retains its pigmentation for at least ten years after preservation. This black pigment appears in conspicuous patches in the preserved specimen and doubtless presented a characteristic feature of the body in life.

Digestive system. The mouth and rhynchodeum open separately. The epithelium lining the mouth is much folded, the outer folds protruding beyond the ventral surface of the head as a circle of folded lips (Pl. II, fig. 1). The size of the mouth indicates that the worm is capable of ingesting comparatively large objects but as the digestive organs were empty, no information as to the nature of the prey is available. Other bathypelagic nemerteans are known to feed upon various worms and crustaceans.

The foregut, including pylorus, is very short, necessitating an equally short caecum. The single pair of caecal diverticula, which extend forward to the dorsal side of the brain, are profusely branched. The diverticula of the midgut are correspondingly branched, with a profusion of lobules extending laterally on both dorsal and ventral sides of the nerve cords (Pl. II, figs. 4, 5). This type specimen had 12 pairs of well-formed diverticula, in addition to three small posterior pairs with small lobes only (Pl. II, fig. 1).

Blood-vascular system. Cephalic lacunae and lateral vessels are present in the usual positions. A rudimentary dorsal vessel lies beneath the proboscis sheath for a short distance posterior to the brain region and then enters the rhynchocoel. It terminates in a small lacuna a fraction of a millimeter farther back.

Nervous system. The brain is so large that it fills most of the space within the cephalic walls in the region that it occupies. The lateral nerve cords extend posteriorly between the dorsal and ventral branches of the midgut diverticula and about equidistant between the proboscis sheath and the lateral margins of the body. There is only a single fibrous core (Pl. II, fig. 2). No trace of the dorsal core which Brinkmann (1907) describes and figures for *P. fusca* could be recognized. A thin sheet of nerve-cord muscles extends along the dorsomedian surface.

The dorsal nerve is small and inconspicuous, as is usually the case with species having very thin body musculatures.

Reproductive system. The only specimen available for study was a mature female with 10 pairs of ovaries, each with a closed oviduct leading to the ventral surface of the body. The ovaries occupy the usual positions between adjacent intestinal diverticula and with one exception on the dorsal sides of the nerve cords (Pl. II, figs. 1, 5). The ovary produces but one or two mature ova at any one time and this specimen offers no evidence as to whether the oviduct opens to allow the egg to be fertilized before it is discharged from the body. The mature ovum is large and is provided with thousands of deeply-stained yolk granules.

In addition to the one or two large ova, the ovary contains several small ovocytes without yolk and these presumably begin in sequence to form yolk as soon as the mature ovum has been discharged. It is uncertain whether development of the embryo may begin within the body, for no evidence to that effect has yet been found in any of the bathypelagic species.

Habitat. The single known representative of this species was taken in the Bermuda area at a depth of about 1,200 meters.

Type Specimen: Holotype, Cat. No. 311-599; Net 1217; August 24, 1931. Deposited in the collections of the Department of Tropical Research, New York Zoological Park, New York City.

33. *Parabalaenanemertes* (?) *zonata* (Joubin).

Planktonemertes zonata Joubin, 1906; *Parabalaenanemertes* (?) *zonata* Coe, 1926.

Two specimens, which have as yet been studied only superficially, were collected in the central North Atlantic in nets drawn from 3,000 meters to the surface.

Genus *Probalaenanemertes* Brinkmann.

34. *Probalaenanemertes irenae* Wheeler, 1934.

The two known representatives of this species were taken in the South Atlantic west of the Cape of Good Hope in a net drawn from a depth of 1,000 meters. Both were females. They were associated with *Protopelagonemertes hubrechtii* and *Pelagonemertes rollestoni*.

35. *Probalaenanemertes wijnhoffi* Brinkmann, 1917.

P. wijnhoffi Coe, 1926.

The single known individual of this species, which was a mature female, was taken in the northern part of the North Atlantic (Lat. 56° N., Long. 31° W.) at a depth of about 800 meters.

FAMILY BALAENANEMERTIDAE.

Genus *Balaenanemertes* Bürger.

36. *Balaenanemertes chavesi* (Joubin).
Nectonemertes chavesi Joubin, 1906; *Balaenanemertes chavesi* Brinkmann, 1917; Coe, 1926.

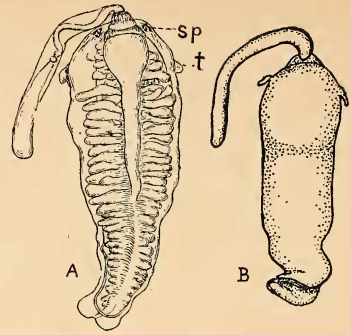
Text-figure 24, A.

The single known specimen was taken in the central North Atlantic in a vertical haul from 3,000 meters.

37. *Balaenanemertes grandis* Brinkmann, 1917.

B. grandis Coe, 1926.

The two known representatives of this



TEXT-FIG. 24. A, *Balaenanemertes chavesi*, dorsal surface of male, showing spermaries (sp) and tentacles (t); B, *B. lobata*, female, body contracted after preservation. (A after Joubin B, after Brinkmann).

species were taken in the northern North Atlantic at depths of 660 and 1,200 meters, respectively.

38. *Balaenanemertes hjorti* Brinkmann, 1917.

B. hjorti Coe, 1926.

Only a single individual has as yet been obtained; it was collected in the central North Atlantic at a depth of about 1,000 meters.

39. *Balaenanemertes lata* Brinkmann, 1917.

B. lata Coe, 1926.

This species is likewise known from but a single specimen taken from a depth of about 1,300 meters in the central North Atlantic.

40. *Balaenanemertes lobata* (Joubin).

Nectonemertes lobata Joubin, 1906; *Balaenanemertes lobata* Brinkmann, 1917; Coe, 1926. (Includes *B. musculocaudata* Brinkmann?).

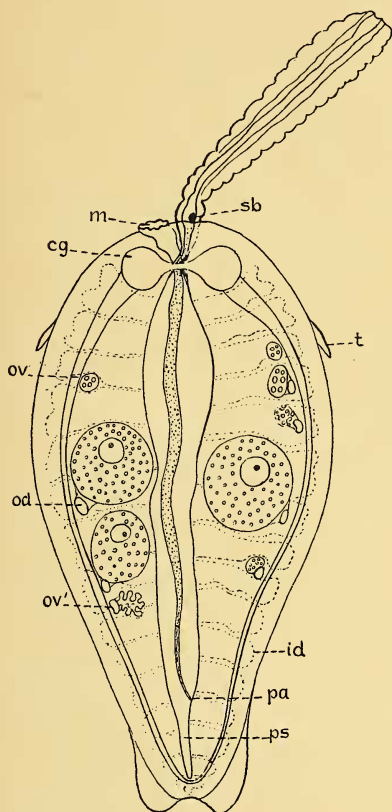
Text-figure 24, B.

Eight individuals which have been referred to this species have been taken in the central and northern North Atlantic (Lat. 36° to 59° N.) in nets lowered to depths of 400 to 3,000 meters. Seven of these were females; at three stations the females were associated with males of *B. musculocaudata*, which are closely similar anatomically except for the gonads but differ in color. Brinkmann himself suggests that such anatomical differences as he found might be merely sexual distinctions. If this supposition is correct, the name *B. musculocaudata* is a synonym of *B. lobata*. In several species of bathypelagic nemerteans the two sexes differ in color.

41. *Balaenanemertes minor* Coe, 1926.

Text-figure 25.

This species is known only from the Bermuda area, where a single individual was caught at a depth of 549 meters.



TEXT-FIG. 25. *Balaenanemertes minor*. Outline of body of mature female with partially everted proboscis, showing 3 large ovaries each containing a single ripe ovum and 6 small ovaries (ov, ov') from which the eggs have been discharged; other letters indicate: cg, cerebral ganglia; id, intestinal diverticula; m, mouth; od, oviduct; pa, attachment of proboscis to proboscis sheath (ps); sb, stylet basis; t, tentacle. (After Coe).

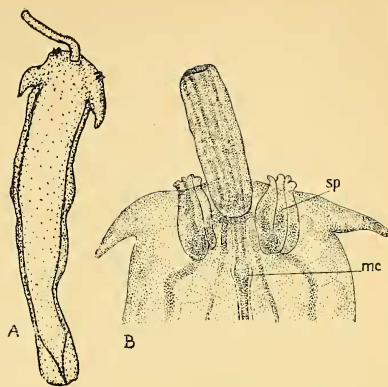
42 (?). *Balaenanemertes musculocaudata*

Brinkmann, 1917.

B. lobata (Joubin) ?*B. musculocaudata* Coe, 1926.

Text-figure 26.

The five individuals thus far obtained were all males; they were collected in the northern North Atlantic; at three stations they were associated with females of *B. lobata*. For the reasons stated above it seems probable that these males actually represent the latter species, but it seems advisable to retain both specific names until further evidence is available.



TEXT-FIG. 26. *Balaenanemertes musculocaudata* (*lobata*?). A, male with partially everted proboscis; B, anterior end of body, showing spermaries (sp) and middle chamber of proboscis (mc). (After Brinkmann).

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EXPLANATION OF THE PLATES.

PLATE I.

Mononemertes scarlata.

- Fig. 1. Outline of body, showing extent of proboscis sheath and proboscis; on one side the 8 spermaries are indicated and on the other side the lobed intestinal diverticula.
- Fig. 2. Diagram of anterior end of body, indicating relation of proboscis and mouth, which open together into a short atrium.
- Fig. 3. Portion of transverse section of body, showing dorsal and ventral branches of one of the intestinal diverticula.
- Fig. 4. Portion of transverse section near posterior end of body, showing intestinal diverticulum without ventral branch. The epithelium covering entire body wall in life is still retained on ventral surface.
- Fig. 5. Portion of transverse section of proboscis sheath, showing interlacing of longitudinal and circular or spiral muscular fibers.
- Fig. 6. Portion of section through caudal fin, with commissure at posterior end of nerve cords and the well developed dorsoventral musculature.
- Fig. 7. Outline of stylet basis, with indications of sockets from which the minute stylets have been dissolved.
- Fig. 8. Transverse and longitudinal sections of lateral nerve cord, showing dorsal fibrous core (**dc**).

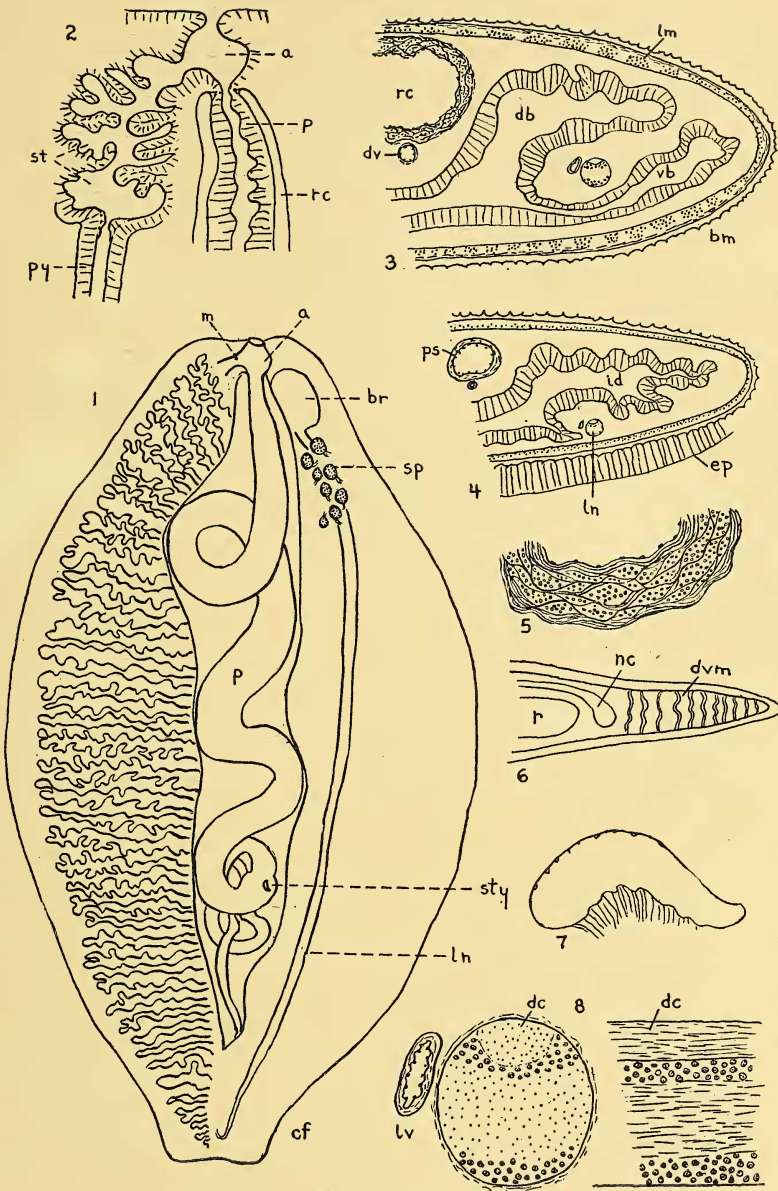
Letters indicate: **a**, atrium; **bm**, basement layer underlying surface epithelium in life; **br**, brain; **cf**, caudal fin; **db**, dorsal branch of intestinal diverticulum; **dc**, dorsal core of

nerve fibers; **dv**, dorsal blood vessel; **dvm**, dorsoventral muscles; **ep**, epithelium; **ln**, lateral nerve cord; **lv**, lateral vessel; **m**, mouth; **nc**, nerve-cord commissure; **p**, proboscis; **ps**, proboscis sheath; **py**, pylorus; **r**, rectum; **rc**, rhynchocoel; **sp**, spermaries; **st**, stomach; **sty**, stylet basis; **vb**, ventral branch of intestinal diverticulum.

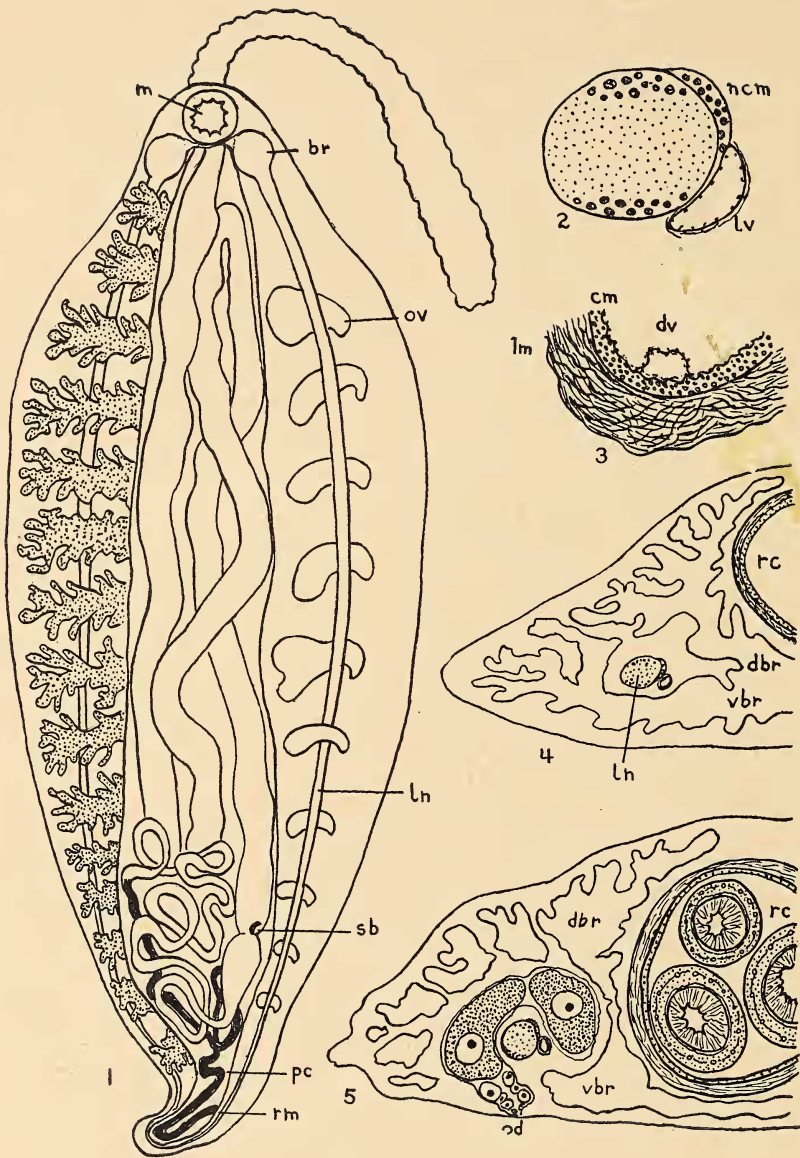
PLATE II.

Parabalaenanemertes nigra.

- Fig. 1. Outline of body of type specimen, showing intestinal diverticula on one side of the body and ovaries (**ov**) on the other side, with the rhynchocoel containing the extremely long, coiled proboscis occupying the central axis; other letters indicate: **br**, brain; **ln**, lateral nerve cord; **m**, mouth; **pc**, posterior chamber of proboscis; **sb**, stylet basis; **rm**, retractor muscle.
- Fig. 2. Transverse section of lateral nerve cord with accompanying nerve-cord muscle (**ncm**) and lateral vessel (**lv**).
- Fig. 3. Portion of transverse section of proboscis sheath with dorsal vessel (**dv**); **cm** and **lm**, circular and longitudinal muscular layers respectively.
- Fig. 4. Portion of transverse section of body, showing the dorsal (**dbr**) and ventral (**vbr**) branches of the intestinal diverticula; **rc**, rhynchocoel; **ln**, lateral nerve cord with accompanying vessel and nerve cord muscle.
- Fig. 5. Portion of transverse section in posterior third of body showing the ovary and oviduct (**od**); letters as in Fig. 4.



BATHYPELAGIC NEMERTEANS OF THE BERMUDA AREA AND OTHER PARTS OF THE NORTH AND SOUTH ATLANTIC OCEANS, WITH EVIDENCE AS TO THEIR MEANS OF DISPERSAL.



BATHYPELAGIC NEMERTEANS OF THE BERMUDA AREA AND OTHER PARTS OF THE NORTH AND SOUTH ATLANTIC OCEANS, WITH EVIDENCE AS TO THEIR MEANS OF DISPERSAL.